

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re New DIVISIONAL Patent Application of:)
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Shigeru SAKUMA et al.)
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Application No.: Not yet Assigned)
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Filed: October 22, 2001)
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Prior Application No.: 09/257,296) Group Art Unit: 1765
)
Prior Application Filed: February 25, 1999) Examiner: B. Tran
)
For: MANUFACTURING METHOD FOR)
CALCIUM FLUORIDE AND CALCIUM)
FLOURIDE FOR PHOTOLITHOGRAPHY)

Commissioner for Patents
Washington D.C. 20231

PRELIMINARY AMENDMENT

Sir:

Prior to examination of the above-identified application on the merits, please amend the application as follows:

Please cancel claims 17-19 and 40-42.

Please amend claims 1, 9, 20, 21, 22, 26, and 33, to read as follows:

1. (Amended) A manufacturing method for a single crystal of calcium fluoride, having its optical properties improved through an annealing process comprising the steps of:

providing a single crystal of calcium fluoride in a sealable container, sealing said container, then

heating said container with a heater arranged external to said container such that a temperature inside said container is raised to a first temperature, which is lower than a melting point of said single crystal of calcium fluoride,

maintaining the temperature inside said container at said first temperature for a designated period of time,

lowering the temperature inside said container to room temperature,

wherein,

the first temperature is between 1020 °C to 1150 °C.

9. (Amended) A manufacturing method for a single crystal of calcium fluoride having its optical properties improved comprising the steps of:

providing a single crystal of calcium fluoride and a fluorination agent in a second container arranged in a sealable first container, sealing said first container, then

heating said first container with a heater arranged external to said first container such that a temperature inside said second container is raised to a first temperature, which is lower than a melting point of said single crystal of calcium fluoride, while said second container is filled with a fluorine gas atmosphere,

maintaining the temperature inside said second container at the first temperature for a designated period of time,

lowering the temperature inside said first container and the temperature inside said second container to room temperature,

opening the inside of said first container to a normal atmosphere,

wherein,

the first temperature is between 1020 °C and 1150 °C.

20. (Amended) A manufacturing method for a single crystal of calcium fluoride, having its optical properties improved comprising the steps of:

providing a single crystal of calcium fluoride in a sealable container, sealing said container, then

heating said container with a heater arranged external to said container such that a temperature inside said container is raised to a first temperature, which is lower than a melting point of said single crystal of calcium fluoride,

maintaining the temperature inside said container at said first temperature for a designated period of time,

lowering the temperature inside said container to room temperature,

wherein,

a balance between an effect of improving the optical properties of said single crystal of calcium fluoride and the productivity, including delivery time and cost, is achieved, such that, during a high temperature range, the temperature is lowered at a slow rate, and during a low temperature range that is lower than the high temperature range, the temperature is lowered faster as the temperature becomes lower.

21. (Amended) A manufacturing method for a single crystal of calcium fluoride, having its optical properties improved comprising the steps of:

providing a single crystal of calcium fluoride in a sealable container, sealing said container, then

heating said container with a heater arranged external to said container such that a temperature inside said container is raised to a first temperature, which is lower than a melting point of said single crystal of calcium fluoride,

maintaining the temperature inside said container at said first temperature for a designated period of time,

lowering the temperature inside said container to room temperature,

wherein,

said container is filled with an inert gas, and the inside of said container is maintained at an atmosphere of approximately 1 atm such that said single crystal of calcium fluoride is not oxidized.

22. (Amended) A manufacturing method for a single crystal of calcium fluoride having its optical properties improved comprising the steps of:

providing a single crystal of calcium fluoride and a fluorination agent in a second container arranged in a sealable first container, sealing said first container, then

heating said first container with a heater arranged external to said first container such that the temperature inside said second container is raised to a first temperature, which is lower than a

melting point of said single crystal of calcium fluoride, while said second container is filled with a fluorine gas atmosphere,

maintaining the temperature inside said second container at the first temperature for a designated period of time,

lowering the temperature inside said second container to room temperature, and

opening the inside of said first container to a normal atmosphere,

wherein,

at a minimum, in order to prevent oxidation of said single crystal of calcium fluoride during the process, the process is carried out such that said fluorination agent is vaporized and becomes a fluorine gas atmosphere inside of said second container, while a pressure inside said first container is maintained at approximately 1 atm.

26. (Amended) A manufacturing method for a single crystal of calcium fluoride, having its optical properties improved comprising the steps of:

providing a single crystal of calcium fluoride in a sealable container, sealing said container, then

heating said container with a heater arranged external to said container such that a temperature inside said container is raised to a first temperature, which is lower than a melting point of said single crystal of calcium fluoride,

maintaining the temperature inside said container at the first temperature for a designated period of time,

lowering the temperature inside said container to room temperature,

wherein,

the first temperature, which is between 1020 °C and 1150 °C, is lowered to a second temperature, which is in the range of around 600 °C to 900 °C, at a rate of 1.2 °C/hour or less.

33. (Amended) A manufacturing method for a single crystal of calcium fluoride having its optical properties improved comprising the steps of:

providing a single crystal of calcium fluoride and a fluorination agent in a second container arranged in a sealable first container, sealing said first container, then

heating said first container with a heater arranged external to said first container such that a temperature inside said second container is raised to a first temperature, which is lower than a melting point of said single crystal of calcium fluoride, while said second container is filled with a fluorine gas atmosphere,

maintaining the temperature inside said second container at said first temperature for a designated period of time,

lowering the temperature inside second container to room temperature,

opening the inside of said first container to a normal atmosphere,

wherein,

the first temperature is between 1020 °C and 1150 °C, and

the temperature is decreased from said first temperature to a second temperature, which is in the range of around 600 to 900 °C, at a rate of 1.2 °C/hour or less.

REMARKS

This Preliminary Amendment amends claims 1, 9, 20, 21, 22, 26, and 33 to improve the form of the claims and cancels claims 17-19 and 40-42. The attached page is captioned
“Version with Markings Showing Changes Made.”

CONCLUSION

The foregoing amendments are being made to place the application in better condition for examination. A favorable action on the merits is respectfully solicited. If there is any fee due in connection with the filing of this Preliminary Amendment, please charge the fees to our Deposit Account No. 50-0310. If a fee is required for an extension of time under 37 C.F.R. 1.136 not accounted for above, such an extension is requested and the fee should also be charged to our Deposit Account.

Respectfully submitted,

MORGAN LEWIS & BOCKIUS LLP

By: Thomas E. Nelson
Thomas E. Nelson
Reg. No. 42,030

Dated: October 22, 2001

MORGAN, LEWIS & BOCKIUS LLP
1800 M Street, N.W.
Washington, D.C. 20036-5869
202-467-7000

VERSION WITH MARKING SHOWING CHANGES MADE

1. (Amended) A manufacturing method for a single crystal of calcium fluoride, having its optical properties improved through an annealing process comprising the steps of:

providing a single crystal of calcium fluoride in a sealable container, sealing said container [~~with a vacuum~~], then

heating said container with a heater arranged external to said container such that a temperature inside said container is raised to a first temperature, which is lower than a melting point of said single crystal of calcium fluoride,

maintaining the temperature inside said container at said first temperature for a designated period of time,

lowering the temperature inside said container to room temperature,

wherein,

the first temperature is between 1020 °C to 1150 °C.

9. (Amended) A manufacturing method for a single crystal of calcium fluoride having its optical properties improved comprising the steps of:

providing a single crystal of calcium fluoride and a fluorination agent in a second container arranged in a sealable first container, sealing said first container [~~with a vacuum~~], then

heating said first container with a heater arranged external to said first container such that a temperature inside said second container is raised to a first temperature, which is lower than a

melting point of said single crystal of calcium fluoride, while said second container is filled with a fluorine gas atmosphere,

maintaining the temperature inside said second container at the first temperature for a designated period of time,

lowering the temperature inside said first container and the temperature inside said second container to room temperature,

opening the inside of said first container to a normal atmosphere,

wherein,

the first temperature is between 1020 °C and 1150 °C.

20. (Amended) A manufacturing method for a single crystal of calcium fluoride, having its optical properties improved comprising the steps of:

providing a single crystal of calcium fluoride in a sealable container, sealing said container [~~with a vacuum~~], then

heating said container with a heater arranged external to said container such that a temperature inside said container is raised to a first temperature, which is lower than a melting point of said single crystal of calcium fluoride,

maintaining the temperature inside said container at said first temperature for a designated period of time,

lowering the temperature inside said container to room temperature,

wherein,

a balance between an effect of improving the optical properties of said single crystal of calcium fluoride and the productivity, including delivery time and cost, is achieved, such that, during a high temperature range, the temperature is lowered at a slow rate, and during a low temperature range that is lower than the high temperature range, the temperature is lowered faster as the temperature becomes lower.

21. (Amended) A manufacturing method for a single crystal of calcium fluoride, having its optical properties improved comprising the steps of:

providing a single crystal of calcium fluoride in a sealable container, sealing said container ~~[with a vacuum]~~, then

heating said container with a heater arranged external to said container such that a temperature inside said container is raised to a first temperature, which is lower than a melting point of said single crystal of calcium fluoride,

maintaining the temperature inside said container at said first temperature for a designated period of time,

lowering the temperature inside said container to room temperature,

wherein,

said container is filled with an inert gas, and the inside of said container is maintained at an atmosphere of approximately 1 atm such that said single crystal of calcium fluoride is not oxidized.

22. (Amended) A manufacturing method for a single crystal of calcium fluoride having its optical properties improved comprising the steps of:

providing a single crystal of calcium fluoride and a fluorination agent in a second container arranged in a sealable first container, sealing said first container ~~[with a vacuum]~~, then

heating said first container with a heater arranged external to said first container such that the temperature inside said second container is raised to a first temperature, which is lower than a melting point of said single crystal of calcium fluoride, while said second container is filled with a fluorine gas atmosphere,

maintaining the temperature inside said second container at the first temperature for a designated period of time,

lowering the temperature inside said second container to room temperature, and

opening the inside of said first container to a normal atmosphere,

wherein,

at a minimum, in order to prevent oxidation of said single crystal of calcium fluoride during the process, the process is carried out such that said fluorination agent is vaporized and becomes a fluorine gas atmosphere inside of said second container, while a pressure inside said first container is maintained at approximately 1 atm.

26. (Amended) A manufacturing method for a single crystal of calcium fluoride, having its optical properties improved comprising the steps of:

providing a single crystal of calcium fluoride in a sealable container, sealing said

container [~~with a vacuum~~], then

heating said container with a heater arranged external to said container such that a temperature inside said container is raised to a first temperature, which is lower than a melting point of said single crystal of calcium fluoride,

maintaining the temperature inside said container at the first temperature for a designated period of time,

lowering the temperature inside said container to room temperature,

wherein,

the first temperature, which is between 1020 °C and 1150 °C, is lowered to a second temperature, which is in the range of around 600 °C to 900 °C, at a rate of 1.2 °C/hour or less.

33. (Amended) A manufacturing method for a single crystal of calcium fluoride having its optical properties improved comprising the steps of:

providing a single crystal of calcium fluoride and a fluorination agent in a second container arranged in a sealable first container, sealing said first container [~~with a vacuum~~], then

heating said first container with a heater arranged external to said first container such that a temperature inside said second container is raised to a first temperature, which is lower than a melting point of said single crystal of calcium fluoride, while said second container is filled with a fluorine gas atmosphere,

maintaining the temperature inside said second container at said first temperature for a designated period of time,

lowering the temperature inside second container to room temperature,

opening the inside of said first container to a normal atmosphere,

wherein,

the first temperature is between 1020 °C and 1150 °C, and

the temperature is decreased from said first temperature to a second temperature, which is
in the range of around 600 to 900 °C, at a rate of 1.2 °C/hour or less[5] =

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